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(54) Title of the Invention: Antibacterial agents

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SPECIFICATION

1. TITLE OF THE INVENTION

Antibacterial agents

2. SCOPE OF THE PATENT CLAIMS

1. Antibacterial agents containing yucca.

2. Antibacterial agents, as claimed in claim 1, which exhibit effects on at least one type of microorganism, selected from: genus *Pseudomonas*, genus *Staphylococcus*, genus *Vibrio*, genus *Bacillus*, genus *Clostridium*, genus

Campylobacter, genus *Aeromonas*, genus *Flavobacterium*, genus *Escherichia* and genus *Salmonella*.

3. DETAILED DESCRIPTION OF THE INVENTION

[1. Field of Industrial Use]

The present invention relates to antibacterial agents containing yucca. In further detail, it relates to antibacterial agents which may be used in foodstuffs, such as general foodstuffs, health foods, ultra-high pressure processed foodstuffs and functional foods.

[2. Description of the Related Art]

A large number of conventional synthetic chemical antibacterial agents which may be used in foodstuffs are known, such as: benzoic acid and salts thereof, biphenyl, sorbic acid and salts thereof, thiapentazole, dehydroacetic acid and salts thereof, *para*-oxybenzoic acid and esters thereof, and propionic acid and salts thereof. Examples of well-known natural antibacterial agents are glycine and phenylalanine.

[Problems to be Solved by the Invention]

However, antibacterial agents comprising synthetic chemical products have strict criteria fixed for their use, are harmful to the human body if errors are made in the quantities used, and problems remain from the aspect

of their safety. The natural products, glycine and phenylalanine etc. do not have problems in terms of safety, but their antibacterial power is weak and, if large quantities thereof are used, they do not exhibit the same level of efficacy as synthetic chemical products and their use is therefore generally avoided.

The antibacterial agents according to the present invention, which comprise natural products which have antibacterial power matching that of synthetic chemical products, and which also have excellent safety without exerting deleterious effects on the human body, are therefore very significant for the human population.

[The Means of Solving the Problems]

The present inventors, as a result of a series of diligent investigations into solving the above-mentioned problems, achieved the present invention by discovering the new fact that yucca has antibacterial power.

Yucca is a plant which has been used as a food from ancient times; its effects have recently been receiving attention with regard to: treatment of arthritis and rheumatism, improvement of digestive function, lowering of high blood pressure, and the like; and, in addition, its *in vivo* safety has been verified from, for example,

observations when it has been added as a whipping agent.

In addition, yucca has antibacterial power which is several levels stronger, when compared with conventional natural products, and, since it has a similar level of effects as synthetic chemical products, it is possible to utilize it as an antibacterial agent, instead of synthetic chemical products.

The present invention will be described in detail below.

The antibacterial agents according to the present invention exhibit effects on at least one type of microorganism, selected from: genus *Pseudomonas*, genus *Staphylococcus*, genus *Vibrio*, genus *Bacillus*, genus *Clostridium*, genus *Campylobacter*, genus *Aeromonas*, genus *Flavobacterium*, genus *Escherichia* and genus *Salmonella*.

With regard to the yucca contained in the antibacterial agents which may be used, all parts of the yucca plant may be used, that is, flowers, seeds, seed pods, fruits, leaves, stems and roots; powders obtained by drying by normal processes, extracts, and the like, are normally used.

Examples of processes for obtaining the aforementioned yucca extracts which may be given are: processes whereby

an aforementioned yucca part is boiled using boiling water; processes wherein yucca is extracted with an organic solvent, such as an alcohol; and processes wherein yucca is merely compressed, but the present invention will not be limited solely to these processes.

With regard to the antibacterial agents formed from the aforementioned yucca parts, it is desirable to add 0.1% or more, preferably 0.5% or more, of a yucca powder or liquid extract to a material. If the proportion added is less than 0.1%, there is a trend towards it being difficult for sufficient antibacterial effects to be displayed, which is the object.

The antibacterial agents display their effects when they are added to foodstuffs such as, for example, juices, minced fish products, cheese, butter, margarine and confectionery.

The ranges of the effects of the antibacterial agents are, strong effects in a range of pH values from 3 to 9, preferably from 4 to 8; and the effects are advantageous from 0° to 70°C, preferably from 0° to 40°C.

The antibacterial agents according to the present invention may be used in any form, depending on the

application, such as powders, dry solids, starch syrups, suspensions and aqueous solutions.

[Action]

The antibacterial agents containing yucca according to the present invention are not harmful, since they are natural products; and their safety has been verified. Furthermore, they have strong antibacterial power.

[Examples of the Execution of the Invention and Control Examples]

The present invention will be described in further detail below, by giving Examples of its execution.

Example 1

Pseudomonas fluorescens, IFO 13922 was inoculated with a platinum loop from a stored slant culture into a culture medium for growth (prepared by dissolving a mixture of: meat extract, 3 g/l; peptone, 10 g/l and sodium chloride, 5 g/l; and adjusting the pH to 7 with 1N aqueous sodium hydroxide solution) and precultured at 30°C for 24 hours. The culture medium was diluted to 5×10^5 cells/ml, after which it was seeded (1 ml to 49 ml) with a culture medium for testing, (prepared by dissolving a mixture of: meat extract, 3 g/l; peptone, 10 g/l and sodium chloride, 5 g/l; and adjusting the pH to 7 with 1N aqueous sodium hydroxide solution), wherein yucca at a concentration

listed in Table 1 had been preadded; incubation was carried out at 30°C, and determinations were made, by the standard agar plate method, of the numbers of viable bacteria after 3 days and after 7 days. The results are listed in Table 1.

Table 1

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	2.3×10^3	0	0	5.5×10^9
After 7 days	2.1×10^3	0	0	6.3×10^9

Initial Number of Bacteria: 1×10^4

Example 2

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Staphylococcus aureus* IFO 12732). The results are listed in Table 2.

Table 2

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	4.1×10 ³	0	0	7.0×10 ⁹
After 7 days	3.7×10 ³	0	0	8.0×10 ⁹

Initial Number of Bacteria: 1×10^4

Example 3

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured

was *Vibrio parahaemolyticus* IFO 12711). The results are listed in Table 3.

Table 3

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	8.3×10^3	0	0	6.3×10^9
After 7 days	7.5×10^3	0	0	6.6×10^9

Initial Number of Bacteria: 1×10^4

Example 4

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Bacillus subtilis* IFO 3009). The results are listed in Table 4.

Table 4

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	2.1×10^4	0	0	5.2×10^9
After 7 days	7.8×10^3	0	0	6.1×10^9

Initial Number of Bacteria: 1×10^4

Example 5

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Clostridium perfringens* ATCC 13124). The results are listed in Table 5.

Table 5

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	8.2×10^3	0	0	4.3×10^9
After 7 days	7.8×10^3	0	0	5.1×10^9

Initial Number of Bacteria: 1×10^4

Example 6

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Campylobacter jejuni/coli* ATCC 33559). The results are listed in Table 6.

Table 6

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	3.5×10^3	0	0	6.2×10^9
After 7 days	3.7×10^3	0	0	6.3×10^9

Initial Number of Bacteria: 1×10^4

Example 7

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Aeromonas sorbia* ATCC 9071). The results are listed in Table 7.

Table 7

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	6.5×10^3	0	0	4.3×10^9
After 7 days	6.8×10^3	0	0	4.8×10^9

Initial Number of Bacteria: 1×10^4

Example 8

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Flavobacterium lutescens* IFO 12997). The results are listed in Table 8.

Table 8

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	3.9×10^3	0	0	5.5×10^9
After 7 days	3.1×10^3	0	0	6.0×10^9

Initial Number of Bacteria: 1×10^4

Example 9

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Escherichia coli* IFO 3301). The results are listed in Table 9.

Table 9

Number of Viable Bacteria		(Units: no. of cells)		
Yucca concentration	0.3%	0.7%	1.5%	0% (Control)
After 3 days	5.2×10^3	0	0	1.1×10^{10}
After 7 days	3.8×10^3	0	0	1.2×10^{10}

Initial Number of Bacteria: 1×10^4

Example 10

The test was carried out according to the example in Example 1, with the exception that the bacterium cultured was *Salmonella enteritidis* IFO 3313). The results are listed in Table 10.

Table 10

Number of Viable Bacteria		(Units: no. of cells)			
Yucca concentration		0.3%	0.7%	1.5%	0% (Control)
After 3 days		4.1×10^3	0	0	8.9×10^9
After 7 days		3.8×10^3	0	0	9.0×10^9

Initial Number of Bacteria: 1×10^4

Control Examples 1 to 10

The tests were carried out according to the example in Example 1, but the antibacterial agent glycine comprising a nature-identical product was used instead of yucca, and the bacteria listed in Table 11 were used. The results are listed in Table 11.

Table 11

Control Example	Concentration Added Name of Bacterium	0.3%		0.7%		1.5%		0% (Control)	
		After 3 days	After 7 days	After 3 days	After 7 days	After 3 days	After 7 days	After 3 days	After 7 days
1	<i>Pseudomonas fluorescens</i>	6.1×10^7	5.9×10^7	4.9×10^7	5.1×10^7	5.0×10^7	5.2×10^7	5.5×10^7	6.3×10^7
2	<i>Staphylococcus aureus</i>	3.8×10^7	4.3×10^7	3.9×10^7	4.3×10^7	4.1×10^7	4.2×10^7	7.0×10^7	8.0×10^7
3	<i>Vibrio parahaemolyticus</i>	6.5×10^7	7.1×10^7	6.8×10^7	6.9×10^7	6.6×10^7	6.7×10^7	6.3×10^7	6.6×10^7
4	<i>Bacillus subtilis</i>	5.0×10^7	5.1×10^{10}	5.0×10^7	5.0×10^7	2.1×10^7	2.3×10^7	5.2×10^7	6.1×10^7
5	<i>Clostridium perfringens</i>	5.1×10^7	5.3×10^7	4.2×10^7	5.0×10^7	4.8×10^7	5.1×10^7	4.3×10^7	5.1×10^7
6	<i>Campylobacter jejuni/coli</i>	2.9×10^7	3.1×10^7	3.0×10^7	3.2×10^7	2.8×10^7	2.9×10^7	6.2×10^7	6.3×10^7
7	<i>Aeromonas sorbia</i>	4.8×10^7	5.1×10^7	5.2×10^7	5.5×10^7	5.1×10^7	5.3×10^7	4.3×10^7	4.8×10^7
8	<i>Flavobacterium lutescens</i>	1.9×10^7	2.1×10^7	2.0×10^7	2.3×10^7	2.2×10^7	2.4×10^7	5.5×10^7	6.0×10^7
9	<i>Escherichia coli</i>	3.8×10^7	2.9×10^7	2.2×10^7	2.9×10^7	5.8×10^7	6.2×10^7	1.1×10^{10}	1.2×10^{10}
10	<i>Salmonella enteritidis</i>	1.5×10^{10}	9.8×10^7	3.1×10^7	2.5×10^7	2.9×10^7	2.3×10^7	8.9×10^7	9.0×10^7

Initial Number of Bacteria: 1×10^4

Control Examples 11 to 20

The test was carried out according to the example in Example 1, but the antibacterial agent phenylalanine, comprising a nature-identical product, was used instead of yucca, and the bacteria listed in Table 12 were used. The results are listed in Table 12.

Table 12

Control Example	Concentration Added Name of Bacterium	0.3%		0.7%		1.5%		0% (Control)	
		After 3 days	After 7 days	After 3 days	After 7 days	After 3 days	After 7 days	After 3 days	After 7 days
11	<i>Pseudomonas fluorescens</i>	7.2×10^7	6.9×10^7	7.1×10^7	7.2×10^7	7.0×10^7	7.1×10^7	5.5×10^7	5.3×10^7
12	<i>Staphylococcus aureus</i>	4.1×10^7	4.2×10^7	3.9×10^7	3.9×10^7	4.1×10^7	4.3×10^7	7.0×10^7	8.0×10^7
13	<i>Vibrio parahaemolyticus</i>	6.8×10^7	7.0×10^7	6.6×10^7	7.1×10^7	6.7×10^7	6.8×10^7	6.3×10^7	6.6×10^7
14	<i>Bacillus subtilis</i>	4.8×10^7	4.9×10^7	5.0×10^7	5.1×10^7	4.8×10^7	4.5×10^7	5.2×10^7	6.1×10^7
15	<i>Clostridium perfringens</i>	5.5×10^7	5.6×10^7	5.5×10^7	5.6×10^7	5.6×10^7	5.8×10^7	4.3×10^7	5.1×10^7
16	<i>Campylobacter jejuni/coli</i>	2.8×10^7	3.0×10^7	3.2×10^7	3.3×10^7	3.5×10^7	3.6×10^7	6.2×10^7	6.3×10^7
17	<i>Aeromonas sorbia</i>	4.5×10^7	4.7×10^7	4.6×10^7	4.8×10^7	4.7×10^7	4.7×10^7	4.3×10^7	4.8×10^7
18	<i>Flavobacterium lutescens</i>	2.2×10^7	2.3×10^7	2.3×10^7	2.3×10^7	2.1×10^7	2.2×10^7	5.5×10^7	6.0×10^7
19	<i>Escherichia coli</i>	6.5×10^{10}	4.8×10^{10}	6.1×10^{10}	5.7×10^{10}	5.6×10^{10}	5.5×10^{10}	1.1×10^{10}	1.2×10^{10}
20	<i>Salmonella enteritidis</i>	2.1×10^{10}	3.0×10^{10}	2.6×10^{10}	2.8×10^{10}	3.0×10^{10}	3.2×10^{10}	8.9×10^7	9.0×10^7

Initial Number of Bacteria: 1×10^4

[Effects]

The antibacterial agents containing yucca according to the present invention are not harmful to the human body, since they are natural products; and their safety has been verified. Since they also have strong antibacterial power, they are very significant antibacterial agents for the human population.

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Translator's Report/Comments

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In translating the above text we have noted the following apparent errors/unclear passages which we have corrected or amended:

Page/para/line*	Comment
3/1/3	The Japanese says " <i>Vibrio parachemolyticus</i> ".
4/2/3,4	The Japanese says "Table 10".
4/3/3,4	The Japanese says "Table 11".
Tables	The two larger tables (10 and 11) have also been renumbered 11 and 12, respectively, in the translation.
Tables	Most of the superscript numbers in Tables 11 and 12 are completely illegible in the original document. The text as appears on certain patent websites has also proved illegible, and so these numbers cannot be reproduced. They have been denoted by a question mark (?) in the translation.

* This identification refers to the source text. Please note that the first paragraph is taken to be, where relevant, the end portion of a paragraph starting on the preceding page. Where the paragraph is stated, the line number relates to the particular paragraph. Where no paragraph is stated, the line number refers to the page margin line number.